

REMARKS

Responsive to the Office Action mailed March 31, 2010, entry of this paper and reconsideration and allowance of the application is earnestly requested.

Status of the claims

Claims 1-8 and 11-20 were examined.

Claims 1-8 and 11-20 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over CN1215503 in view of Camras et al., U.S. Pub. No. 2002/0093023 (hereinafter "Camras") in further view of Urbanek, U.S. Pub. No. 2005/0042845 (hereinafter "Urbanek").

CN1215503

The Office has not provided an English-language translation of CN1215503. Applicants note that a translation should be provided by the Office:

If the document is in a language other than English and the examiner seeks to rely on that document, a translation must be obtained so that the record is clear as to the precise facts the examiner is relying upon in support of the rejection. The record must also be clear as to whether the examiner is relying upon the abstract or the full text document to support a rejection.

MPEP § 706.02.

In the absence of such translation, Applicants make reference to Inoue et al., U.S. Pat. No. 6,333,522 (hereinafter "Inoue"). Inoue is indicated on its face to be a §371 (U.S.) National Stage entry of PCT/JP97/04916, while CN1215503 is indicated on its face to be the Chinese National Stage entry of PCT/JP97/04916.

In making these observations and referencing Inoue herein, Applicants do *not* make any affirmative assertion that the content of Inoue is equivalent to that of CN1215503, but rather are relying on the above-described "apparent" equivalence. *If the Office continues to apply CN1215503 against any claims in the next Office Action, Applicants earnestly request that the Office provide an English-language translation as per MPEP § 706.02.*

Claim amendments

Claim 1 is amended to remove two extraneous commas. Applicants respectfully submit that the scope of claim 1 is unaltered by this clarifying amendment.

Claim 11 is amended to correct an antecedent basis issue. Applicants respectfully submit that the scope of claim 11 is unaltered by this clarifying amendment.

**The claims present patentable subject matter
and should be allowed**

Claim 1 recites a method for fabricating a flip-chip light emitting diode device, the method including: (a) depositing epitaxial layers on a growth substrate to produce an epitaxial wafer; (b) fabricating a plurality of light emitting diode devices on the epitaxial wafer; (c) *dicing the epitaxial wafer* to generate at least one separated *device die* from the epitaxial wafer, said device die including at least one of the plurality of the light emitting diode devices and a portion of the growth substrate; (d) *flip chip bonding the device die to a mount*, said flip chip bonding including securing the device die to the mount by bonding an electrode of the device die to a bonding pad of the mount; and (e) *subsequent to step (d), removing at least some of the growth substrate from the device die by laser lift off*.

The Office Action recognizes the novelty of claim 1, but proposes that claim 1 is obvious in view of a proposed combination of CN1215503, Camras, and Urbanek. Applicants respectfully traverse.

CN1215503 is cited as allegedly showing steps (a)-(d) of claim 1. Applicants readily acknowledge that the process of depositing epitaxial layers on a growth substrate to produce an epitaxial wafer; fabricating a plurality of light emitting diode devices on the epitaxial wafer; dicing the epitaxial wafer to generate at least one separated device die from the epitaxial wafer, and flip chip bonding the device die to a mount, is known, as shown by way of illustrative example in Inoue.

The Office Action acknowledges that CN1215503 (and, for that matter, Inoue) do not disclose or fairly suggest step (e): *subsequent to step (d), removing at least*

some of the growth substrate from the device die by laser lift off. The Office Action proposes to modify CN1215503 by Camras which is alleged to disclose:

Fixing the die of the light emitting diode to the submount 130 by the solder connections 132 and 136 and removing some of the substrate 117 for its benefit of increasing light emission intensity of the light emitting diode device. See paragraphs 0052, 0060, 0063-0069 of the Specification; and Figs. 4, 7A-7F and 8 of [Camras].

Office Action pages 3-4.

Applicants agree that Camras discloses flip-chip bonding, e.g. at ¶[0051]-[0052]. Applicants agree that Camras discloses removing some of the substrate for its benefit of increasing light emission intensity of the light emitting diode device.

However, Camras does *not* disclose the *sequence* of (d) flip chip bonding the device die to a mount ... and (e) *subsequent to step (d) [i.e., the flip-chip bonding]*, removing at least some of the growth substrate *from the device die*. Indeed, the Office Action does not expressly allege that Camras discloses this *sequence*, and the Office Action also does not expressly allege that Camras discloses removing at least some of the growth substrate *from the device die*.

Camras does *not* use the sequence of flip-chip bonding *followed by* removing at least some of the growth substrate from the device die. For example, Camras Fig. 5 shows mounting the superstrate (117) (Fig. 5A to 5B) followed by removal of the sacrificial substrate (140) (Fig. 5B to 5C) followed by formation of the electrodes (118, 120) (Fig. 5C to 5D). The flip chip bonding is performed *after* the electrodes are formed, that is, *after* the removal of the sacrificial substrate. Camras does suggest that the order of operations may be modified in some respects (*see* Camras ¶[0059] and Fig. 6 disclosing an alternative in which the sacrificial substrate is removed before attaching the superstrate; Camras ¶[0060] disclosing an alternative in which the active layers are grown directly onto the superstrate; and Camras ¶[0061] disclosing that the superstrate may be attached before or after dicing). However, there is no fair suggestion of any sequence in which flip-chip bonding is performed *followed by* removing at least some of the growth substrate from the device die.

Moreover, the Office Action at least implicitly acknowledges that neither CN1215503 nor Camras disclose removing at least some of the growth substrate from

the device die *by laser lift off*. This further deficiency is proposed to be remedied by the further inclusion of Urbanek into the proposed combination.

Applicants agree that Urbanek discloses removing a sapphire substrate by laser lift off. However, Urbanek does *not* disclose or fairly suggest *subsequent to the flip-chip bonding*, removing at least some of the growth substrate *from the device die*. Indeed, Urbanek discloses precisely the opposite, namely performing the laser lift off *before* dicing. See Urbanek ¶[0056], ¶[0073], ¶[0089], ¶[0107], ¶[0120].

Still further, Urbanek provides affirmative evidence of the *nonobviousness* of claim 1. Consider: Urbanek recognizes substantial problems in performing wafer-level laser lift-off: the lift-off must be performed in multiple, sequential exposures, and this can result in large stresses and cracking of the GaN film. See, e.g., Urbanek ¶[0010], ¶[0052]. Urbanek proposes two solutions. The first solution is a "background" solution of etching trenches into the GaN prior to laser processing, in order to provide some chip-to-chip isolation. Urbanek ¶[0011]. The second solution is to employ shadow masking during the laser-liftoff. See, e.g., Urbanek ¶[0051], ¶[0053], ¶[0068], ¶[0070], ¶[0084], ¶[0102].

Both of these solutions proposed by Urbanek have substantial problems. The "background" solution of ¶[0011] is identified by Urbanek itself as being problematic due to potentially ineffective isolation and/or weakened support wafer bonding and possible consequent delamination. Urbanek ¶[0011]. The latter approach of using a shadow mask would increase the complexity of the optical system, and presumably would require that substantial care be taken during the subsequent dicing in order to ensure that the dicing is aligned with the pattern defined by the shadow mask.

How about this solution: dice the epitaxial wafer to generate a separated device die, flip chip bond the device die to a mount including securing the device die to the mount by bonding an electrode of the device die to a bonding pad of the mount, *and then* remove at least some of the growth substrate from the device die by laser lift-off? This solution is recited in *claim 1 of the present application*.

How does claim 1 solve the problems identified in Urbanek? The device die has a substantially smaller area compared with the wafer so as to substantially reduce the likelihood of build-up of thermal stresses as compared with wafer-level processing. Indeed, if the device die is small enough (e.g., about 2 mm² or smaller using the laser

of Urbanek), the delamination might be performed in a single exposure, thus eliminating the problems identified by Urbanek.

Urbanek does not disclose or even fairly suggest this allegedly "obvious" solution set forth in claim 1 of the present application. Instead, Urbanek teaches a *completely different solution*, namely using *wafer-level* laser-liftoff processing with shadow masking to alleviate stress build-up. A reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claim. MPEP § 2141.02. Urbanek, considered in its entirety, as a whole, does not fairly suggest claim 1, but rather leads away from claim 1.

CN1215503 and Camras cannot remedy these deficiencies of Urbanek because (1) CN1215503 does not even disclose substrate removal and (2) Camras also does not fairly suggest the sequence recited in claim 1, or removing at least some of the growth substrate from the flip-chip bonded *device die*.

Applicants also note that Urbanek has a filing date of July 14, 2004, which is *after* the provisional filing date (December 23, 2003) of the present application. Accordingly, it is not apparent whether the subject matter of Urbanek relied upon in the Office Action qualifies as rebuttable *prima facie* prior art under § 102(e). If the next Office Action continues to rely upon Urbanek for any rejections, Applicants request that the Office Action affirmatively show that the relied-upon subject matter qualifies as rebuttable *prima facie* prior art under § 102(e), for example by showing that the subject matter was disclosed in a provisional application upon which Urbanek relies that was filed prior to December 23, 2003.

Claim 14 recites depositing epitaxial layers on a sapphire growth substrate to produce an epitaxial wafer; fabricating a plurality of light emitting diode devices on the epitaxial wafer; *dicing* the epitaxial wafer *to generate a device die*; *flip chip bonding the device die to a mount*, the flip chip bonding including securing the device die to the mount by bonding at least one electrode of the device die to at least one bonding pad of the mount; and *with the device die flip chip bonded to the mount*, *removing the sapphire growth substrate of the device die using a laser lift off process*.

CN1215503 does not disclose substrate removal. Camras discloses substrate removal, but does not disclose or fairly suggest using a laser lift off process or performing the removing with the device die flip chip bonded to the mount. Urbanek discloses substrate removal using a laser lift off process, but does not disclose or fairly suggest performing the removing with the device die flip chip bonded to the mount, and indeed teaches to the contrary performing the substrate removal as a *wafer-level* operation including *shadow masking* to alleviate stress buildup.

For at least the reasons set forth above, it is submitted that claims 1-8 and 11-20 (all claims) present patentable subject matter and meet all statutory requirements. Accordingly, Applicants earnestly request reconsideration and allowance of the application including claims 1-8 and 11-20.

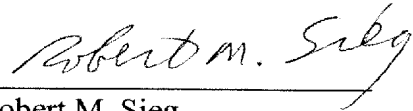
CONCLUSION

For at least the reasons set forth above, it is submitted that claims 1-8 and 11-20 (all claims) present patentable subject matter and meet all statutory requirements. Accordingly, Applicants earnestly request reconsideration and allowance of the application including claims 1-8 and 11-20.

If personal contact is deemed advantageous to the disposition of this case, the Examiner is requested to telephone the undersigned at 216.363.9000.

Respectfully submitted,

FAY SHARPE LLP

A handwritten signature in cursive script, reading "Robert M. Sieg". The signature is written in dark ink and is positioned above a horizontal line.

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